

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Lynch Creek.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Effingham, S. C.	35	12	9.7	7	6.0	17-19	7.5	3.7
Potomac River.								
Harpers Ferry, W. Va.	170	16	8.8	6	2.3	19, 20	3.8	6.5
Roanoke River.								
Clarksville, Va.	155	12	6.7	6	0.9	17	2.2	5.8
Sacramento River.								
Red Bluff, Cal.	241	23	0.6	1	- 0.6	26-31	-0.3	1.2
Sacramento, Cal.	70	25	10.3	1	7.6	13	8.5	2.7
Sanjee River.								
St. Stephens, S. C.	50	12	7.9	13, 14	5.8	22	7.2	2.1
Congaree River.								
Columbia, S. C.	37	15	3.5	6	0.3	18	1.3	3.2
Wateries River.								
Camden, S. C.	45	24	13.1	7	4.4	16	7.3	8.7

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Savannah River.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Augusta, Ga.	130	32	16.2	5	7.9	17, 19	10.0	8.3
Susquehanna River.								
Wilkesbarre, Pa.	178	14	10.5	24	3.0	1-6	4.1	7.5
Harrisburg, Pa.	70	17	7.8	25	1.9	18	3.7	5.9
Juniata River.								
Huntingdon, Pa.	80	24	5.9	23	3.2	4	4.0	2.7
W. Br. of Susquehanna.								
Williamsport, Pa.	35	20	8.3	24	1.3	17	3.0	7.0
Waccamaw River.								
Conway, S. C.	40	7	5.6	13, 14	3.7	31	4.9	1.9

* Distance to Gulf of Mexico. † Record for 25 days. ‡ Record for 26 days.
§ Record for 27 days. ¶ Record for 30 days.

THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspects of the weather of the month are presented in the tables which form the closing part of this REVIEW. Table I, in particular, contains numerous details that are important in the study of climatology. The numerical values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to IX, inclusive.

PRESSURE AND WIND.

Normal conditions.—The geographic distribution of normal barometric readings at sea level and under local gravity for December is shown by Chart V of the MONTHLY WEATHER REVIEW for December, 1893.

Normal pressure in December, as in November, is highest over the middle Plateau where it is above 30.20 inches; it is also above 30.20 over eastern Tennessee, the western part of the Carolinas and northern Georgia. Normal pressure in December is lowest over the Gulf of St. Lawrence whence there is a marked gradient toward the permanent area of low pressure on the North Atlantic. Normal pressure is also below 29.95 at Tatoosh Island, Washington, and there is a marked gradient from that place northwestward to the permanent area of low pressure in the North Pacific.

As compared with November, normal pressure increases in all regions except from the middle Plateau to the north Pacific coast.

In December, the prevailing winds on the Atlantic coast are northwesterly or off-shore; in the Gulf States northeasterly or easterly; on the upper Lakes westerly; on the lower Lakes southwesterly; and on the plains east of the Rocky Mountains northwesterly. Elsewhere the winds are more or less variable, no single direction predominating over a considerable stretch of territory.

The current month.—The distribution of mean pressure for the current month is shown on Chart IV. The noteworthy features of the month are (1) the merging of the middle Plateau and South Atlantic highs into one great high, extending from eastern Oregon to Georgia, with a mean pressure of 30.55 inches in southern Idaho; (2) the unusually high pressure that prevailed over the Rocky Mountain and plateau regions.

As compared with November, 1898, mean pressure increased from 0.1 to 0.3 inch from the ninety-fifth meridian westward to the Pacific, the greatest increase being in southern Idaho and western Wyoming. Mean pressure in December decreased

slightly in North Carolina and also in the lower Lake region and the St. Lawrence Valley.

Mean pressure was above normal west of a line drawn from Charleston, S. C., to Bismarck, N. Dak. It was below normal in the Lake region, the upper Ohio Valley, the Middle States and New England.

The weather conditions on the Pacific coast were largely dominated by the position and magnitude of the Plateau high.

TEMPERATURE OF THE AIR.

Normal conditions.—The normal temperature of the air in the United States in December varies from about 70° at Key West, 56° at Jacksonville, 55° at New Orleans, 57° at Galveston, 56° at San Diego, to 26° at Eastport, 25° at Burlington, 30° at Buffalo, 29° at Detroit, 18° at Duluth, 6° at St. Vincent, 21° at Havre, 32° at Spokane, and 42° at Seattle, on Puget Sound. The warmest regions are the lower Rio Grande Valley and Florida; the coolest, Minnesota and South Dakota.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

The current month.—The temperature of the month was considerably below normal in all but a very few regions, although the departures on the Atlantic coast and in New England were not large. The greatest deficiencies, 7° to 10° occurred over a large tract of country extending from central Texas northwestward to the State of Washington, and almost coincident with the area of high pressure already noted. Generally from the Mississippi River eastward the departures were less than 5° per day.

The highest maximum temperatures of the month, 80° and over, were registered in Florida, the Lower Rio Grande Valley and southern California. A maximum of 92° was registered at Rio Grande City, Texas. The lowest maximum temperatures of the month 35° to 40°, were observed in portions of Iowa, Wisconsin and Minnesota.

The lowest minimum temperature of the month, 57° below zero, was observed in central Minnesota. Freezing temperatures occurred in all portions of the country, except central and southern Florida and the coastal regions of California.

There was a light cold wave in the Gulf States on the 4th and 5th, in the central Rocky Mountain region and Texas on the 9th and 10th, in New England on the 12th, and quite generally in the central valleys on the 13th and 14th. A light cold wave moved eastward over the Lake region on the 24th and 25th and again on the 27th and 28th. The most severe and widespread cold wave of the month appeared over the northwest on the morning of the 29th. It moved rapidly southward and eastward carrying the line of zero temperature to Oklahoma and the Lake region by the morning of the 31st. During the night of the 31st the cold wave spread eastward to the Atlantic coast, causing zero temperatures in the Middle Atlantic States and falls in temperature from 24° to 38° from the Gulf coast to New England.

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by black and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	30.9	- 0.7	+ 13.4	+ 1.2
Middle Atlantic	12	35.8	- 0.5	+ 16.7	+ 1.4
South Atlantic	10	48.0	- 0.6	+ 9.0	+ 0.8
Florida Peninsula	7	60.2	- 1.3	+ 4.0	+ 0.3
East Gulf	7	49.2	- 3.3	- 2.4	- 0.2
West Gulf	7	45.4	- 6.0	- 4.5	- 0.4
Ohio Valley and Tennessee	12	34.9	- 3.3	+ 14.3	+ 1.2
Lower Lake	8	28.4	- 2.1	+ 25.4	+ 2.1
Upper Lake	9	21.4	- 3.2	+ 24.6	+ 2.0
North Dakota	7	11.1	- 1.0	+ 18.2	+ 1.5
Upper Mississippi	11	23.3	- 5.2	+ 13.3	+ 1.1
Missouri Valley	10	24.4	- 5.1	+ 13.2	+ 1.1
Northern Slope	7	22.2	- 2.8	+ 0.4	0.0
Middle Slope	6	28.2	- 6.8	+ 0.4	0.0
Southern Slope	5	34.4	- 7.6	- 4.8	- 0.4
Southern Plateau	13	36.5	- 4.4	- 4.2	- 0.4
Middle Plateau	9	23.4	- 5.8	- 15.1	- 1.8
Northern Plateau	11	24.1	- 6.9	- 4.1	- 0.3
North Pacific	9	40.1	- 1.9	+ 6.4	+ 0.5
Middle Pacific	5	47.2	- 1.4	- 7.0	- 0.6
South Pacific	4	52.9	+ 0.2	+ 4.1	+ 0.3

In Canada.—Prof. R. F. Stupart says:

The temperature was a little below average over British Columbia and throughout Ontario, except in the extreme eastern portion, where the average was just maintained; in all the remaining portions of the Dominion it was above average, the excess being particularly marked in the Northwest Territories, and strikingly so in northern Alberta, where Edmonton reports as much as 11° above average. In eastern Canada, Quebec reports the greatest amount above average; namely, 3°, and Halifax, Sydney and Charlottetown each give an excess of 2°. The interior portion of the lower Lake region gives the greatest general amount below average, Brantford and Lucknow each reporting a deficiency of 3°.

PRECIPITATION.

Normal conditions.—Heavy rains in December (4 to 6 inches and over) occur in the Gulf States, lower Mississippi and

Ohio valleys, Tennessee, over limited areas on the Atlantic coast and on the coasts of California, Washington and Oregon. The normal rainfall east of the ninety-fifth meridian, excluding the territory above described, is from 1 to 3 inches. Between the ninety-fifth and one hundred and twenty-first meridians the precipitation of November is light in quantity and variable in distribution.

The current month.—The month was relatively one of the driest of the year, less than the normal precipitation being recorded in all but three districts, viz: Florida peninsula, middle and southern slopes. The drought on the middle and South Pacific coasts continued throughout the month. The rainfall of the north Pacific coast was below normal, although the amount that fell was sufficient for all purposes. Heavy rains fell in parts of Florida, southern Georgia, and Alabama, and the precipitation was above the normal for the season from Wyoming southeastward to central Texas and also throughout the southern half of New Mexico and Arizona.

The pressure distribution in the Plateau region and on the Pacific coast was typical of a dry season on the coast, but favorable to heavy snow in Arizona and New Mexico. (See Chart VI, Bulletin D, Rainfall of the United States.)

The geographic distribution of precipitation is shown on Chart III, and the numerical values for about 3,000 stations appear in Tables II and III, while the details as to excessive rains will be found in Table XI.

The usual details appear in the table below:

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England	10	2.55	70	-1.10	+ 5.70
Middle Atlantic	12	2.62	79	-0.70	- 0.70
South Atlantic	10	2.58	74	-0.90	- 6.70
Florida Peninsula	7	3.83	151	+1.30	- 5.60
East Gulf	7	3.91	91	-0.40	+ 2.30
West Gulf	7	2.40	73	-0.90	- 4.90
Ohio Valley and Tennessee	12	2.22	63	-1.30	- 0.20
Lower Lake	8	2.73	96	-0.10	+ 0.10
Upper Lake	9	1.24	55	-1.00	- 2.20
North Dakota	7	0.27	40	-0.40	- 0.80
Upper Mississippi	11	0.78	39	-1.20	+ 5.00
Missouri Valley	10	0.72	59	-0.50	+ 2.70
Northern Slope	7	0.30	60	-0.20	- 0.30
Middle Slope	6	1.41	155	+0.50	+ 2.80
Southern Slope	6	1.97	155	+0.70	- 2.80
Southern Plateau	13	0.83	67	-0.40	- 2.90
Middle Plateau	9	0.72	47	-0.80	- 2.20
Northern Plateau	11	1.08	50	-1.10	- 3.90
North Pacific	9	6.74	75	-2.20	- 8.30
Middle Pacific	5	1.93	34	-3.70	-18.90
South Pacific	4	0.52	17	-2.60	- 9.20

In Canada.—Professor Stupart says:

The precipitation was a little above average in the western and southwestern portions of the lower Lake region, also from the eastern portion of Lake Superior to about the Ottawa River and embracing the Georgian Bay district. In Cape Breton it was also above average, but seemingly local, whilst in all other portions of Canada it was below average, especially in the Province of Quebec and over Vancouver Island. In the former Province there occurred at Quebec a deficiency of 1.5 inch, and at Father Point 1.6 inch; Victoria, in Vancouver Island records 4.1 inches less than average. In nearly all parts of the Dominion the precipitation was largely snow, and in Ontario, Quebec, and the Maritime Provinces, some heavy falls occurred. The snow storm of the 4th and 5th over Ontario was exceptionally heavy. During this storm Orangeville reports that 28 inches fell, and Collingwood 24 inches. The snowfall during the month in the immediate neighborhood of Owen Sound was phenomenally heavy, the total fall at Owen Sound being reported as 8 feet 3 inches.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 8, 9, 10, 15, 30, 31. Arkansas, 3, 4, 11, 31. California, 28, 29, 30, 31. Colorado, 18. Connecticut, 4, 19, 20,

31. Delaware, 31. District of Columbia, 31. Georgia, 4, 9, 22, 25. Idaho, 24, 28. Illinois, 1, 2, 3, 12, 16, 18, 19, 20, 21, 22, 29, 30. Indiana, 6, 16, 17, 19, 30, 31. Indian Territory, 3, 11, 17. Iowa, 1, 15, 17, 18, 19, 20, 21. Kansas, 8, 9, 13, 23, 26. Kentucky, 4, 16, 30, 31. Louisiana, 3, 8, 9, 10, 13, 14, 15, 30, 31. Maine, 5, 20. Maryland, 3, 17, 19, 31. Massachusetts, 4, 19, 20, 31. Michigan, 2, 4, 5, 19, 20, 30, 31. Minnesota, 19, 20, 26. Missouri, 3, 11, 12, 18, 19, 21, 22, 30. Montana, 1, 19. Nebraska, 19. Nevada, 20. New Hampshire, 4, 5, 20, 21, 30, 31. New Jersey, 4, 17, 19, 20, 31. New Mexico, 8, 9, 10, 17. New York, 4, 17, 19, 20, 21, 22, 31. North Carolina, 2, 3, 4, 11, 12, 13, 31. North Dakota, 20, 28. Ohio, 4, 19, 30. Oklahoma, 8. Oregon, 1, 11, 13, 14, 17, 18, 19, 20, 21, 28, 29, 30, 31. Pennsylvania, 4, 5, 17, 19, 20, 31. South Carolina, 8, 9, 10, 12, 15, 25. South Dakota, 6, 7, 12, 20. Tennessee, 4, 17, 30, 31. Texas, 7, 8, 9, 14, 15, 18, 19, 24, 31. Utah, 2. Vermont, 4, 5, 20, 21. Virginia, 3, 4, 11, 17, 31. Washington, 4, 6, 18, 19, 20. West Virginia, 4, 17, 19, 31. Wisconsin, 19, 20, 24. Wyoming, 30.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 2. Arizona, 8, 9, 10. Arkansas, 31. California, 8, 9, 19, 20, 29, 30. Washington, 17, 19.

SNOWFALL.

The total snowfall for the current month is given in Tables I and II, and its geographic distribution is shown on Chart VIII. The limit of snow at the end of the month was much farther south than at the same time a year ago. The snowfall of the Plateau region as a whole was perhaps a little above the average, although the fall over small areas here and there was not up to the average. The snowfall of the mountainous regions of Arizona, New Mexico and Colorado, from the best information available, seems to have been considerably above the average. The snowfall of the upper Mississippi and Missouri Valleys was a trifle heavier than for the corresponding month a year ago, while the average depth in New England was not so great as in 1897. Little snow fell east of the Appalachians south of Lynchburg, Va., and the fall of western Georgia and Alabama was also quite light. The fall of the Sierra Nevadas in California seems to have been below the average.

The depth of snow on the ground at the end of the month.—The southern limit of snow on the ground at the close of the month was slightly farther south than on the corresponding date a year ago. The ground was free from snow, however, over considerable areas north of the southern limit of no snow, particularly in southern Ohio and Indiana, Illinois and a considerable portion of North Dakota. A greater portion of the Plateau region was covered with snow at the end of the month than was the case a year ago; and this was also the case on the Upper Peninsula of Michigan and in northern Wisconsin.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In gen-

eral the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of pressure on the evaporation and therefore on the temperature of the wet-bulb thermometer has had the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

The current month.—The month was cold and deficient in rainfall in a majority of districts, and we should, therefore, expect low absolute humidity and relatively clear skies.

Relative humidity was above normal in seven districts, exactly normal in five and below in the remaining nine, as against six, four, and eleven, respectively, in November, 1898, whence it appears there was a slight increase in the relative humidity of the air but not in the absolute humidity.

The greatest changes in the relative humidity of the current, as compared with the preceding, month occurred in the southern Plateau, viz: from 10 per cent below normal to 1 per cent above. The drought on the Pacific coast, noted in the November REVIEW was intensified considerably during December, there being an increase in the dryness of the air throughout the entire region.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	76	+ 1	Missouri Valley	75	0
Middle Atlantic	74	0	Northern Slope	68	+ 1
South Atlantic	75	- 4	Middle Slope	71	+ 6
Florida Peninsula	82	0	Southern Slope	72	+ 5
East Gulf	75	- 3	Southern Plateau	49	+ 1
West Gulf	78	0	Middle Plateau	65	- 2
Ohio Valley and Tennessee	75	0	Northern Plateau	81	0
Lower Lake	77	- 1	North Pacific Coast	82	- 6
Upper Lake	83	+ 2	Middle Pacific Coast	66	- 18
North Dakota	78	- 1	South Pacific Coast	56	- 18
Upper Mississippi Valley	78	+ 2			

WIND.

The winds of the month were not unusually boisterous for the season. The Gulf storm of the 4th and 5th was attended by winds of high velocity in its course from the Mississippi Valley to the Lakes. The majority of the high velocities